



# ***JPRS Report***

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### New Fast Neutron Detector Developed by CAS Institute

93P60044A Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 21 Sep 92 p 3

[Article by Song Wenjie [1345 2429 2638]: "New Fast Neutron Detector Developed by CAS Lanzhou Institute of Modern Physics"]

[Summary] A new type of fast neutron detector developed by the CAS Lanzhou Institute of Modern Physics with the assistance of the Northwest Institute of Nuclear Technology passed expert technical appraisal a few days ago. This new detector, the first of its kind developed domestically, will be of critical significance to national defense R&D, since its static high-vacuum capture and long-term maintenance performance parameters match those of the international state-of-the-art. This detector, incorporating polyvinyl and other organic materials, has an operating vacuum of  $1 \mu\text{Pa}$ , and can maintain a vacuum of a few 10,000ths of a pascal for over 120 days, far surpassing the design goal of 6 pascals for 60 days.

### Two-Dimensional, Two-Phase Flow Model To Analyze Interior Ballistics of Large-Caliber Gun Round

92FE0804A Beijing LIXUE XUEBAO [ACTA MECHANICA SINICA] in Chinese Vol 24 No 3, May 92 pp 312-319

[Article by Jin Zhiming [6855 1807 2494], Weng Chunsheng [5040 2504 3932], and Yuan Yaxiong [5913 0068 7160] of the East China Institute of Technology, Nanjing, 210014: "Numerical Simulation of Two-Dimensional Two-Phase Flow During the Ignition and Flame Propagation Process in a Dense Granular Bed"; supported by the National Natural Science Foundation; MS received 1 May 91, revised 18 Nov 91]

[Abstract] An unsteady two-dimensional two-phase axial-symmetric flow model for dense particles with chemical reactions and a one-dimensional two-phase flow model for igniter are established to study the interior ballistics of a large-caliber gun. Figure 1 shows the high-density granular bed structure with a built-in igniter studied in this work. The igniter is comprised of two tubes. A fast ignition charge is used to ensure that the energy of the igniter charge can grow and propagate rapidly to ignite the charge particles in the main chamber. When the pressure inside the charge chamber is higher than that in the igniter, the combustion gas might backflow into the igniter.

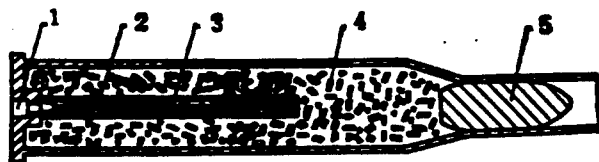


Figure 1. A New Igniter

Key: 1. Detonator; 2. Flame tube; 3. Outer tube; 4. Main charge; 5. Projectile

The interior ballistics of a gun involve a number of high-temperature, high-pressure transient processes. Numerical simulation is difficult because the flow between the main charge bed and the igniter is coupled. Furthermore, during the ignition and flame propagation process, not only are physical parameters rapidly changing with time, but there are also large radial and axial gradients. Moreover, there are apparent pressure fluctuations. To date, successful numerical simulation studies are limited to one-dimensional two-phase models.

In this paper, an unsteady axial-symmetric two-phase flow model is established and the MacCormack finite difference method is employed for numerical computation to study the impact of radial effects on the interior ballistics. The physical model and basic equations are discussed. The numerical method, including coordinate transformation and difference format and stability conditions, is presented in detail. Artificial viscosity is taken into consideration based on the Rucanov method and a set of initial boundary conditions are given. Finally, the numerical results are presented and discussed.

The ignition process of the charge bed is shown in Figure 4, where "0" represents charge that has not been ignited and "X" represents charge that has been ignited. It illustrates that there is considerable thermal convection near the flaming hole and that a portion of the charge is ignited first. The flame front propagates rapidly toward the wall and is then reflected by the wall to ignite the charge near the wall. In the meantime, the charge farther away from the flaming hole is also ignited and the flame front propagates toward the other end.

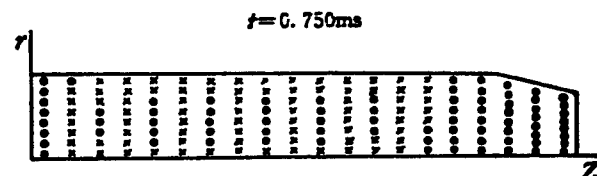


Figure 4. Schematic Diagram of the Ignition Process

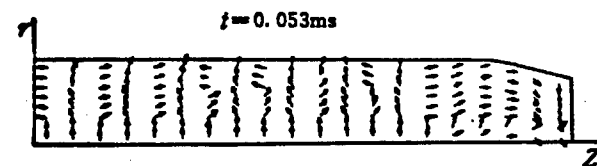


Figure 5. Gas-Phase Velocity Fields at Different Times

Figures 5(A) and (B) represent the gas-phase velocity fields at different times. In the initial stage, there is obvious radial flow and then it develops into predominantly axial flow.

In conclusion, in the ignition and flame propagation process, there is an apparent two-dimensional effect. A two-flame wave propagates from the igniter to the projectile. The charge particles are concentrated at the wall and the projectile, which causes uneven radial and axial distribution and pressure fluctuation. As the projectile begins to move, radial effect is rapidly diminished and it develops into a one-dimensional flow.

#### **Broadband Constant-Beam-Width Array With Four Elements**

40100021A Beijing SHENGXUE XUEBAO  
[ACTA ACUSTICA] in Chinese Vol 17 No 5,  
Sep 92 pp 334-339

[English abstract of article by Chen Guisheng of Shanghai Institute of Testing Technology, Shanghai 200233; MS received 1 Apr 91]

[Text] An acoustical [sonar] array structure with four elements that have the directivity of cosine function over certain frequency band is described. The acoustical axis directions of these elements are staggered  $90^\circ$  off each other, so their main beam can be covered within  $360^\circ$  in the horizontal plane. It is easy to detect the bearing of incident acoustic signal with amplitude-bearing method. Reflective rubber is adopted as a back baffle of the array. It has been verified, in practice, that the constant beam-width for a ratio of high-to-low frequency of 8:1 may be obtained. Moreover, this paper also gives a mathematical model for the array structure. It is consistent with theoretical calculated and practical measured values.

#### **Correction of Located Points in a Hyperbolic Locating System With a Small Planar Array**

40100021B Beijing SHENGXUE XUEBAO  
[ACTA ACUSTICA] in Chinese Vol 17 No 5,  
Sep 92 pp 340-344

[English abstract of article by Li Yingchun and Wu Deming of the Department of Radioelectronics, Beijing University, Beijing 100871; MS received 11 Mar 91]

[Text] A method for correcting the coordinates of an underwater moving target obtained by a hyperbolic locating system with a small planar array when the sound velocity varies with depth is reported. This is an iteration method using a series of differential difference equations to determine iterative values. The results calculated by this method show that under the same conditions, the location error is about several meters or tens of meters without the correction and less than 0.5 m with the correction. The method can apply to various types of arrays.

#### **Study of Beamforming for Random Line Array**

40100021C Beijing SHENGXUE XUEBAO  
[ACTA ACUSTICA] in Chinese Vol 17 No 5,  
Sep 92 pp 345-354

[English abstract of article by Shan Bingyi of Hangzhou Institute of Applied Acoustics, Fuyang, Zhejiang Prov. 311400; MS received 16 Feb 91]

[Text] In order to solve the uncertainty of the element place for a towed line array, the sample matrix of the signal and the time-space curve equations of the array shape are given in the paper. Average beam patterns of a randomized processing and quantitative result of the loss caused by the array shape distortion are obtained. A model used for estimating array shape is given, and an experimental study of dynamic beamforming has been conducted. The results show that 4 dB gain improvement can be obtained by dynamic compensation for a small towed line array, when the distortion of array shape is medium and towing speed is slow.

**New Method for Separating High-Purity C<sub>60</sub>  
Developed by Beijing University**

93P60045A Beijing KEJI RIBAO [SCIENCE AND  
TECHNOLOGY DAILY] in Chinese 23 Sep 92 p 1

[Article by Tang Dongning [3282 2639 1337]: "Beijing University Invents New Method for Separating High-Purity C<sub>60</sub>"]

[Summary] Beijing University (BU) researchers, with the active support of the State S&T Commission, NSFC, and the State Education Commission, have made a new breakthrough in C<sub>60</sub> R&D: they have invented a new method for separating high-purity C<sub>60</sub>, and have applied for a State patent for these recent experimental results. The new method, developed over a one-year period by scientists in the C<sub>60</sub> research group, composed of representatives from the Chemistry and Physics Departments, is technologically simpler and less expensive than the method now generally used worldwide. With their new method, the BU scientists can produce 99.9 percent pure C<sub>60</sub>, and simultaneously produce enriched C<sub>70</sub>. C<sub>60</sub> researchers from the BU Chemistry Department have already small-batch produced C<sub>60</sub> samples with a purity over 90 percent, and are planning to gradually introduce them to the domestic and overseas markets.

**Interface Morphology and Solute Segregation of  
8090Al-Li Alloy During Unidirectional  
Solidification**

40100019A Beijing JINSHU XUEBAO [ACTA  
METALLURGICA SINICA] in Chinese Vol 28 No 9,  
Sep 92 pp A375-A380

[English abstract of article by Liu Yulin, Zhang Yun, Zhao Hongen, Hu Zhuangqi, and Shi Changxu of the Institute of Metal Research, CAS, Shenyang 110015; MS received 11 Oct 91, revised 28 Jan 92]

[Text] The solid-liquid interface morphology and solute segregation behaviour of 8090Al-Li alloy during unidirectional solidification are studied by the liquid metal quenching method under varied processing conditions. When solidification rate,  $R < 0.13$  or  $> 0.75$  mm/min (temperature gradient,  $G_L = 130^\circ\text{C}/\text{cm}$ ), the structure revealed planar or dendritic interface, respectively. With the increase of  $R$ , the interface morphology becomes cellular from planar gradually within a narrow range. And the greater  $R$  is, the finer the dendrite will be. Segregation of element Cu and of impurity elements Fe and Si is quite severe. The interface morphology markedly influences solute segregation. During solidification at coarse dendrite interface, their segregation ratios are rather great and solidified structure is coarse.

**Stability of Nanocrystalline Ni-P Ribbon**

40100019B Beijing JINSHU XUEBAO [ACTA  
METALLURGICA SINICA] in Chinese Vol 28 No 9,  
Sep 92 pp B405-B408

[English abstract of article by Shui Jiapeng, Cheng Lifang, Liu Junmin, and Chu Zhaoqin of the Institute of Solid State Physics, CAS, Hefei 230031; MS received 22 Oct 91, revised 20 Apr 92]

[Text] Stability of nanocrystalline Ni-P ribbon is investigated by DSC [differential scanning calorimetry] and internal friction technique. The nanocrystalline Ni-P ribbon seems to be unstable within range of 518 to 887 K owing to obvious exothermal phenomenon, decrement of internal friction values and grain coarsening.

**Diffusion Bonding of Superplastic LC4 Al Alloy**

40100019C Beijing JINSHU XUEBAO [ACTA  
METALLURGICA SINICA] in Chinese Vol 28 No 9,  
Sep 92 pp B413-B418

[English abstract of article by Huang Yan and Ma Longxiang of Northeast University of Technology, Shenyang 110006; MS received 26 Mar 91, revised 5 Jun 91]

[Text] Diffusion bonding of superplastic LC4 Al alloy, with prior surface treatment of organic solution protecting coating after electropolishing and stainless steel wool brushing, is performed by Gleeble test machine under following conditions: 490-530°C, 1.0-3.0 MPa, 30-180 min and vacuum of  $1.0 \times 10^{-3}$  Pa. The joints are found to have similar strength and microstructure to the base metal. Discussion is made on the effect of superplastic treatment on bonding. The micromechanism for diffusion bonding of superplastic metal is suggested as the migration of original bond interfaces caused by atomic diffusion and grain growth. Experimental results for the alloy as quench-aged state are presented to compare with the superplastic one.

**On In Situ Forming of TiB<sub>2</sub>-Reinforced Al  
Composite**

40100019D Beijing JINSHU XUEBAO [ACTA  
METALLURGICA SINICA] in Chinese Vol 28 No 9,  
Sep 92 pp B419-B422

[English abstract of article by Ma Zongyi, Bi Jing, Lu Yuxiong, Shen Hongwei, and Gao Yinxuan of the Institute of Metal Research, CAS, Shenyang 110015; MS received 28 Dec 91, revised 2 Jun 92]

[Text] In situ forming of TiB<sub>2</sub>-reinforced Al composite is favourably prepared by reaction-sintering of pure Al, Ti and B powders under vacuum. It is of microsize and practically free from lattice defect. A superior room-temperature strength and modulus, as well as good elevated temperature properties, are obtained in comparison with those of pure Al.

**Tensile, Adhesive Strengths of Fine TiN Film on Ti Substrate**

40100019E Beijing JINSHU XUEBAO [ACTA METALLURGICA SINICA] in Chinese Vol 28 No 9, Sep 92 pp B423-B426

[English abstract of article by Liu Changqing, Li Meishuan, Jin Zhujing, and Wu Weitao of Corrosion Science Lab., Institute of Corrosion and Protection of Metals, CAS, Shenyang 110015; MS received 25 Jun 91, revised 18 Apr 92]

[Text] The cantilever bending test, particularly monitored by an acoustic emission technique, is adopted to measure the tensile and interfacial adhesive strengths of the HCD ion-plated fine TiN film on pure Ti substrate. The causes of film damaging are found to be: for TiN facing upward, an exceeded internal tensile stress over its tensile strength, and for TiN facing downward, an exceeded shearing stress along film/substrate interface over its adhesive strength. The measured tensile and adhesive strengths are 603 and 242 MPa, respectively.



**Molecular Cloning and Expression of *Vibrio cholerae* LPS O-Antigen Genes in *E. coli* HB101**

40091002L Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 19 No 4, Aug 92 pp 378-384

[English abstract of article by Huang Hongjin [7806 1738 6651] and Ma Qingjun [7456 3237 6874] of the Institute of Biotechnology, Academy of Military Medical Sciences, Beijing]

[Text] The chromosomal fragments of *Vibrio Cholerae* Classic Biotype and Eltor Biotype were cloned respectively with vector plasmid pUC18 and B.S(M13<sup>+</sup>). Recombinants which could express the LPS O-Antigen of *Vibrio cholerae* were obtained, and the expressed O-Antigen expressed had very good specificity and immunogenicity. After analyzing the recombinant plasmids by restriction endonucleases digestion, it was found the size of foreign fragments in pMG-301 and pMG-302 were 8.4 kb and 7.6 kb, which were much smaller than 16 kb fragment reported by documents<sup>6,16</sup> and great difference existed between the gene's structure.

**References**

6. H. M. Ward, et al., 1987, Gene, 55: 194.

16. Paul A. Manning, et al., 1986, Infect. Immun., 53 (2): 272.

**cDNA Cloning of the 10th Segment of Rice Dwarf Virus Genome (RDV-S<sub>10</sub>) and Its Transcription *in vitro***

40091002G Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 32 No 4, Aug 92 pp 247-252

[English abstract of article by Deng Dalun [6772 1129 4858], Kang Liangyi [1660 5328 0308], et al. of the Institute of Microbiology, Academia Sinica, Beijing]

[Text] The viral dsRNAs were isolated from purified RDV particles. The cDNA of RDV-S<sub>10</sub> dsRNA was synthesized and cloned using the two synthetic primers, which were 15 and 14 nucleotides complementary to the 3'-end of RDV-S<sub>10</sub> dsRNA respectively, and transcribed into RNA *in vitro*. 2 x 10<sup>-12</sup> gram RDV nucleic acids and the RDV nucleic acids of 1.25 x 10<sup>-4</sup> gram infected rice can be detected in dot-blot hybridization with <sup>32</sup>P-labeled cDNA as probe.

**Cloning of *Shigella flexneri* 2a Group and Type Antigen Gene *in vivo* and Expressing in *Salmonella typhimurium* Vaccine Strain G30**

40091002F Beijing SHENGWU GONGCHENG XUEBAO [CHINESE JOURNAL OF BIOTECHNOLOGY] in Chinese Vol 8 No 3, Aug 92 pp 305-308

[English abstract of article by Dai Xiuyu [2071 4423 3768] and Wang Aoquan [3769 2407 0356] of the

Institute of Microbiology, Academia Sinica, Beijing, and Mu Zhaoqin [3664 0340 2953] of the Institute of Microbiology and Epidemiology, Academy of Military Medical Sciences, Beijing]

[Text] A recombinant plasmid pXD43 with genes specifying the *S. flexneri* group and type antigens located near the pro (6 min) and his (44 min) chromosomal markers, respectively, was *in vivo* constructed and transferred to the galE *S. typhimurium* strain G30. Plasmid re-transferring, curing and DNA electrophoresis analyses confirmed that the *S. flexneri* antigen genes were carried on plasmid pXD43.

**Regulatory Mode of pac Gene Expression**

40091002A Beijing SHENGWU GONGCHENG XUEBAO [CHINESE JOURNAL OF BIOTECHNOLOGY] in Chinese Vol 8 No 3, Aug 92 pp 213-217

[English abstract of article by Jiang Qiaoling [5592 1564 3781] and Yang Shengli [2799 0524 0448] of the Shanghai Research Center of Biotechnology, Chinese Academy of Sciences, and Wu Ruping [0702 3067 1627] of the Shanghai Institute of Materia Medica, Chinese Academy of Sciences]

[Text] 1.65 kb HindIII-BglII DNA fragment containing pac operator was cloned from plasmid pPA4 to pBR322 at HindIII-BamHI sites, resultant plasmid pPA41 was transformed into *E. coli* D816 containing an intact pac operon on its chromosome, then operator titration was performed. It was found that the penicillin acylase activity in *E. coli* D816(pPA41) cells always higher than that in *E. coli* D816 cells. The operators on the high copy plasmid pPA41 competed for the regulatory proteins with the single copy operator on the chromosomal pac operon, thus the expression of pac gene was enhanced, because the free cellular repressors were decreased by operator titration. The results of RNA-DNA hybridization showed that cellular pac mRNA concentration was parallel to the cellular penicillin acylase activity, the pac mRNA content in *E. coli* D816(pPA41) cells was much higher than that in *E. coli* D816 cells. These results indicated that the expression of pac gene was negatively controlled at the transcriptional level.

**Study of the Cultured Human Endothelial Cells Infected by Epidemic Hemorrhagic Fever Virus**

40091002M Beijing ZHONGHUA BINGLIXUE ZAZHI [CHINESE JOURNAL OF PATHOLOGY] in Chinese Vol 21 No 3, Jun 92 pp 177-179

[English abstract of article by Yi Jidong [2496 1376 2639], Chen Dehui [7115 1795 5610], et al. of the Institute of Basical Medical Science, Chinese Academy of Military Medical Sciences, Beijing]

[Text] Virus antigen could be detected in the cytoplasm of infected human endothelial cells (HEC) by immunofluorescent assay (IFA) 2 to 10 days after the inoculation

of epidemic hemorrhagic fever virus (EHFV), but no apparent histologic changes could be found by phase contrast light microscopy, as well as no mature virus particles could be detected under the transmission electron microscope. Reinoculation of the freeze-melt supernatant of HEC 8 days after the inoculation of EHFV to EHFV susceptible Vero E-6 cells, viral antigen could be detected in most of these cells and mature EHFV particles or viral inclusion bodies could also be obtained in the cytoplasm under transmission electron microscope. The results show that HEC is a susceptible target cell to EHFV and infection by this virus may not give apparent cytopathogenic effect in HEC.

**Studies on the Preparation and Properties of L-B Films Formed From Azobenzene Derivative Without Hydrophilic Groups**

40091002N Beijing HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese Vol 50 No 8, Aug 92 pp 740-745

[English abstract of article by Feng Xusheng [7458 4872 0524], Yin Benhua [1438 2609 5478], et al. of the Institute of Colloid and Interface Chemistry, Shandong University, Jinan, 250100, Zhang Baowen [1728 1405 2429], Wu Shikang [0702 0013 1660], and Cao Yi [2580 1837] of the Institute of Photographic Chemistry, Academia Sinica, Beijing; project supported by the National Natural Science Foundation of China]

[Text] The synthesis of 4-(N-hexadecylamino)azobenzene was outlined. The composition and structure of the compound were identified by elemental analysis and  $^1\text{H}$  NMR spectra. The properties of mixed monolayer of the compound with polar arachidic acid was described. The L-B films consisting of the mixed monolayer were deposited onto hydrophobic optical glass or quartz slides successfully. The UV-Vis absorption spectra were recorded in solution and in L-B films. The peak of maximum absorption of solution was at 396 nm while that of L-B films at 388.5 nm. It showed a small blue shift which is indicative of forming a H-aggregates in the L-B film. The position of absorption peak of different layers were not changed but the absorbance increased with the increasing number of layers. This confirmed that there was no molecular aggregates between adjacent layers and that the uniformity of successive monolayers vertically is good. The orientation of azobenzene chromophores in the L-B films were examined by polarized-light absorbance measurements. The diffraction patterns of L-B films were measured. The Bragg peaks were specified. The value of lattice spacing calculated from the Bragg formula was 5.49 nm. This indicated that the L-B films built up of azobenzene derivative were ordered multilayer films with periodic structure.

**Construction of Avirulent *Salmonella typhimurium* Strain Expression *Escherichia coli* LT-B Antigen**

40091002B Beijing SHENGWU GONGCHENG XUEBAO [CHINESE JOURNAL OF BIOTECHNOLOGY] in Chinese Vol 8 No 3, Aug 92 pp 227-231

[English abstract of article by Yang Xiao [2799 2556], Chen Tianmi [7115 3240 1736], Zhang Beining [1728 5563 1337], and Huang Cuifen [7806 5050 5358] of the Institute of Biotechnology, Academy of Military Medical Sciences, Beijing]

[Text] An avirulent  $\Delta\text{cya}$   $\Delta\text{crp}$   $\Delta\text{asd}$  strain of *Salmonella typhimurium* SR-11 was used as host. The recombinant plasmid containing heat-labile enterotoxin B subunit gene and  $\text{asd}^+$  gene was constructed, and was introduced into the host by double-transformation. The hybrid strain is a balanced lethal recombinant. Detections by special methods showed that the hybrid strain having no drug resistance gene could express LT-B antigen at high level. The hybrid strain is worth considering as a foundation for studying on bivalent live oral vaccine strain against ETEC [enterotoxin E. coli] diarrhea and relative *Salmonella* disease.

**A Perfusion System for High Productivity of Monoclonal Antibody by Hybridoma Cells in a CelliGen Bioreactor**

40091002D Beijing SHENGWU GONGCHENG XUEBAO [CHINESE JOURNAL OF BIOTECHNOLOGY] in Chinese Vol 8 No 3, Aug 92 pp 243-248

[English abstract of article by Chen Yikai [7115 6318 6946] of the Laboratory of Genetic Engineering, Fujian Medical College, Fuzhou]

[Text] DA4-4 (ATCC HB57) is a shear sensitive mouse-mouse hybridoma cell, producing monoclonal antibody IgG1 against human IgM. It was grown successfully in a perfusion propagation system consisting of a 1.5L CelliGen stirred bioreactor and Hollow fiber cartridge. CelliGen system had low shear forces and cells can grow well at high agitation of 150 rpm. The culture was maintained for 40 days and cell number reached  $32 \times 10^6/\text{ml}$ . Maximal monoclonal antibody concentration was 4.75 mg/ml. This system produced about 1.0g of antibody per day.

**Study and Preparation of Vi-PHA Reagent and Its Application for Detection of *Salmonella typhi* Carriers**

40091002H Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 32 No 4, Aug 92 pp 289-295

[English abstract of article by Bao Xinghao [7637 5887 6275], Qiu Jianming [6726 1696 2494], et al. of Sanitary and Epidemic Center of Zhejiang Province, Hangzhou]

[Text] Purified *S. typhi* Vi antigen is sensitized with equal volume of tannic acid-treated formalin sheep erythrocytes (SRBC) at a final concentration of 1 µg/ml. The Vi-passive hemagglutination assay (Vi-PHA) diagnostic reagent is developed to detect Vi antibodies to *S. typhi* for the detection of chronic carriers after typhoid fever and the screening of *S. typhi* healthy carriers from food-handlers, which is characterized with high sensitivity, strong specificity and good stability. This Vi-PHA reagent is able to detect 1.16 µg/ml of Vi antibodies and doesn't make any cross reaction with healthy sera. For the sera of other diseases, the cross rate is only 0.84 percent. Using this reagent, 19 positive sera (6.93 percent) are detected from 274 convalescent sera from typhoid fever, 14 of which are stool-culture *S. typhi* positive, that persists a positive rate of 73.68 percent; 3 positive sera are detected from 106 food-handlers, one of which is stool-culture *S. typhi* positive. Therefore, the reagent is simple, convenient, rapid and easy to be applied in basic unit.

#### Transposition of Tn917 in *Bacillus pumilus*

40091002I Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 32 No 4, Aug 92 pp 305-307

[English abstract of article by Geng Yunqi [5105 6663 3825] and Jiang Ruzhang [5592 1172 3864] of the Department of Biology, Nankai University, Tianjin]

[Text] Transposition Tn917 was introduced into *Bacillus pumilus* 289 by protoplast transformation with plasmid pTV32. The temperature-sensitive replication property of pTV32 was maintained in *B. pumilus*. Tn917 was transposed efficiently in *B. pumilus* with  $4.8 \times 10^{-4}$  transposition rate. The yield of auxotrophs was about 0.65 percent in all insertional mutants. It indicated a prospect for the use of Tn917 as a tool for insertional mutagenesis and genetic manipulation in *B. pumilus*. pTV32 is a useful tool for gene expression and regulation research.

#### Isolation of Vitamine B<sub>2</sub> Auxotroph and Preliminary Genetic Mapping in *Salmonella typhimurium*

40091002J Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 19 No 4, Aug 92 pp 362-368

[English abstract of article by Wang Aoquan [3769 2407 0356] of the Institute of Microbiology, Academia Sinica, Beijing]

[Text] The first independent Vitamine B<sub>2</sub> auxotrophs of *Salmonella typhimurium* were obtained by using selective medium containing extraordinarily high concentration of B<sub>2</sub> (300 µg/ml) after mutagenesis. Transduction analysis showed that 21 B<sub>2</sub> auxotrophs could be divided into four groups, which were unlinked to each other. It means that at least 4 structural genes were involved in B<sub>2</sub> biosynthetic pathway. Preliminary genetic mapping indicated that 2

genes located in 7'-22' and other 2 located in 22'-34' and 61.5'-69' region on the genetic map of *S. typhimurium* respectively.

#### The Construction of Genomic Library *Alcaligenes faecalis* and Cloning of *nifH* Gene Sequence Homologous to *Klebsiella pneumoniae*

40091002K Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 19 No 4, Aug 92 pp 369-377

[English abstract of article by Hai Weili [3189 0251 0500] and You Chongshao [1429 1504 2626] of the Institute for Application of Atomic Energy, CAAS, Beijing, and Zheng Honggang [6774 3163 0474] and Wang Bin [3769 2430] of the Institute of Genetics, CAS, Beijing]

[Text] A genomic library of *Alcaligenes faecalis* A-15 H1 which possesses rather high nitrogenase activity has been constructed. The total DNA of *A. faecalis* A-15 H1 was partially digested with *Sau3A*I. 13-20 kb of fragments recovered from agarose gel were cloned in bacteriophage EM-BL4 vector. A total number of  $1.2 \times 10^6$  of recombinants was obtained. It is much beyond the desired capacity of a library. By using *nifH* gene of *K. pneumoniae* from plasmid pGB1 as probe, the researchers have successfully screened the clone containing its homologous sequence. The recombinant bacteriophage DNA was digested with *Eco*RI. A 3.5 kb of hybridizing band appeared after southern blotting and then was cloned in pUC19 DNA. The result of southern blotting indicated that the recombinant plasmid clone contained *nifH* gene sequence of *A. faecalis*. This clone was named as pAFH.

#### Utilization of the Protoplast Fusion Technique To Alter Lincomycin Producing Microorganism

40091002C Beijing SHENGWU GONGCHENG XUEBAO [CHINESE JOURNAL OF BIOTECHNOLOGY] in Chinese Vol 8 No 3, Aug 92 pp 237-242

[English abstract of article by Xu Jingning [1776 0079 1337], Mi Guandong [4717 6306 2639], and Tang Xiaoxuan [0781 1321 1357] of the Research Institute of Biochemical Engineering, East China University of Chemical Technology, Shanghai]

[Text] The results of interspecific recombination through protoplast fusion between *S. lincolnensis* var *lincolnensis* No. 36 (LM<sup>r</sup>, CTC<sup>r</sup>) producing lincomycin and *S. aureofaciens* (LM<sup>r</sup>, CTC<sup>r</sup>) producing chlorotetracycline were reported. A heavy dose of UV radiation was used to inactivate the protoplasts of the *S. aureofaciens*. The UV inactivated protoplasts were fused with the viable protoplasts of *S. lincolnensis* var *lincolnensis* No. 36. The frequency of protoplast fusion was  $9.05 \times 10^{-5}$  (with PEG 6000).

The fermentation product of fusant No. 2 show new chromatographic spot similar to that of clindamycin. A new antibiotic substance produced by recombinant No.

3, which is different from lincomycin and chlorotetracycline is obtained. The product of recombinant No. 3 with antimicrobial activity show a peak at 210 nm wavelength. It suggests that its basic structure might be similar to that of lincomycin.

**Estimation for Model Parameters of Batch Fermentation Kinetics**

40091002E Beijing SHENGWU GONGCHENG XUEBAO [CHINESE JOURNAL OF BIOTECHNOLOGY] in Chinese Vol 8 No 3, Aug 92 pp 283-287

[English abstract of article by Fang Baishan [2455 2672 1472] and Lin Jinqing [2651 6855 3237] of the Department of Chemical and Biochemical Engineering, Hua Qiao University, Quanzhou]

[Text] The analytical solution based on the common mathematical model of fermentation kinetics describing the feature of batch fermentation is deduced. The parameters of the fermentation kinetics in the analytical solution (i.e.,  $\mu_{max}$ ,  $K_s$ ,  $\alpha$ ,  $\beta$ ,  $Y_G$ ,  $Y_p$  and  $m$ ) are estimated at one strike with POWELL optimization algorithm coded in FORTRAN-77. The experimental data, as an example, is quoted from batch lysine fermentation using *corynebacterium glutamicum* [5].

The result shows that: 1) The calculated values of the mathematical model agree with the experimental data well; 2) The synthesis rate of lysine depends on both the growth rate and the concentration of the biomass.

## U.S. Firms Target Chinese Computer Market

### Sybase Inc.

93P60046A Beijing JISUANJI SHIJIE [CHINA  
COMPUTERWORLD] in Chinese No 37, 23 Sep 92 p 1

[Article by Li Liangyu [2621 5328 3768]: "Sybase Targets China Software Market"]

[Summary] The well-known U.S. database firm Sybase Inc. held a Sybase technology and products press conference in Beijing on 8 September 1992. Making a special trip to Beijing for the press conference was a Sybase vice director and Asia-Pacific region representative, who is in charge of the China market. This representative introduced some of Sybase's advanced technology, including multiline-search servers, long-range process transfer, database triggers, replication servers, control servers, data navigators, etc. After the implementation of the "China Computer Software Protection Regulations," Sybase entered the China market in December 1991, and over the past 10 months its Pacific Sybase Division has been actively seeking long-range cooperation with Chinese clients. Current plans call for the establishment before the current year's end of eight to ten joint ventures, four to six software experimental centers, and a 24-hour technological services unit.

### Wyse Technology

93P60046B Beijing JISUANJI SHIJIE [CHINA  
COMPUTERWORLD] in Chinese No 38, 30 Sep 92 p 1

[Article by Li Liangyu [2621 5328 3768] and Fang Yuhua [2075 3768 5478]: "China's Computer Market Becomes Hot New Area for Foreign Commercial Competition: Wyse, Weishi, and Haihua Hand-in-Hand Develop Chinese Market"]

[Summary] Since August of this year, the nation's computer market has become a hot new spot for foreign competition. Following upon the press conferences, new-product exhibitions, and joint ventures set up by the U.S. firms Compaq, Borland, IBM, and Sybase, the U.S. firm Wyse Technology in cooperation with its Hong Kong affiliate Weishi [0251 0099] and its mainland China representative Haihua Computer Corp. held a Wyse New-Product Exhibition in Beijing on 15 September. Wyse unveiled its newest 486 microcomputers with chip accelerators and local bus graphics technology; by replacing the CPU, one can adjust clock chip speed quite easily. The system is compatible with Intel clock-speed-multiplying chip accelerators and the 16-33 MHz 486SX and DX processors as well as the 50-66 MHz DX2 processors. Wyse has made it clear that it is seeking technological cooperation and joint development and production with Chinese computer firms and circles. Finally, Wyse gave five of its DECISION MATE 486SLC Notebook computers—the type used by NASA in the United States—to the Ministry of Aerospace Industry (MAS) as gifts to congratulate MAS on the success of the Aussat launch.

### Microsoft Corp.

93P60046C Beijing JISUANJI SHIJIE [CHINA  
COMPUTERWORLD] in Chinese No 38, 30 Sep 92 p 3

[Article by Chen Jian [7115 0313]: "Legend Group Is First To Cooperate on Software Development With U.S. Firm Microsoft Corp."]

[Summary] The Legend Group recently concluded an agreement with the U.S. firm Microsoft Corp. to jointly develop a Chinese-language version of Microsoft's Works software. This is the first cooperative project between mainland China and the world's largest software firm. Legend has already completed the basic development of this Chinese Works software, to be run on Legend's Chinese character computer systems, and hopes to introduce the new product to the market by year's end, following completion of rigorous testing now underway.

### Novell Inc., 3Com Corp., Maxtor Corp., Japan's Epson

93P60046D Beijing JISUANJI SHIJIE [CHINA  
COMPUTERWORLD] in Chinese No 38, 30 Sep 92 p 5

[Article by Liu Jiuru [0491 0046 1172] and Li Liangyu [2621 5328 3768]: "EpsonNet Plan To Promote China Network Applications"]

[Summary] On 18 September in Beijing, a consortium of four major international computer firms—Japan's Seiko and the U.S. firms Novell Inc., 3Com Corp., and Maxtor Corp.—formally unveiled its "EpsonNet Plan," by which the four firms will provide to Chinese users a series of computer network hardware and software products, systems, and technological services. As part of the plan, Epson will furnish servers and workstations, Novell will provide network operating systems, 3Com will provide network cards, and Maxtor will furnish data storage equipment.

### SGI (Silicon Graphics)

93P60046E Beijing ZHONGGUO DIANZI BAO [CHINA  
ELECTRONICS NEWS] in Chinese 30 Sep 92 p 2

[Article by Wu Ruisheng [0702 3843 3932]: "U.S. Firm SGI Unveils New Computer Products in Beijing"]

[Summary] A few days ago in Beijing, the U.S. computer firm SGI [Silicon Graphics, Inc.] held a new-product exhibition and press conference, at which it unveiled two new computer products to be marketed in China: the R4000 IRIS Indigo PC family and the Reality Engine graphics card. The IRIS Indigo RISC PC family, based

on 50 MHz MIPS R4000SC processors, has an operating performance of 70 SPECmarks, 85 MIPS, and 16 MFLOPS. The Reality Engine graphics card can process over 600,000 grains per second or over 320 million pixels per second.

### Two Neural Network Systems Certified

93P60047C Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 39, 7 Oct 92 p 2

[Article by Li Hongfang [2621 1347 5364]: "New Results in Nation's Intelligent Computer Research"; cf. early report in JPRS-CST-92-010, 22 May 92 p 27]

[Summary] The State 863 Plan project assigned to China University of Science & Technology (CUST) and entitled "Architecture Supporting Neural Information Processing and Its Software Support Environment" recently [8 April] passed the appraisal organized by the State S&T Commission. This project consists of two subprojects, specifically, the development of a "general-purpose parallel neural-network simulation system (GP2N2S2)" by engineers in CUST's Computer Department and the development of a "special-purpose-processor-based neural-network simulation system (SP2N2S2)" by specialists in CUST's Electronic Technology Section. GP2N2S2, intended as a research environment and applications tool, has up to 12,000 simulation nodes, over 300,000 connection weights, and a connection update speed of 100,000 IPS [interconnections per second]. SP2N2S2, tracking the worldwide state-of-the-art, consists of hardware based on special-purpose processors (DSP [digital signal processing] chips) and a corresponding software support environment; its main performance parameters are: number of neurons is about 8,000, number of connection weights is 30,000-50,000, and processing speed is 1.49 million weights per second (forward propagation), 61,000 weights per second (back propagation), and 7.4 million weights per second (Hopfield).

### Hebei Completes Packet Switching Network

93P60047B Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 39, 7 Oct 92 p 1

[Article by Wang Xiren [3769 1585 0088]: "Hebei Completes Construction of Packet Switching Network"]

[Summary] A national/provincial public packet switching experimental network, built in a one-year-plus effort by the Hebei Province P&T Research Institute in cooperation with MPT's Institute of Data Research, has been completed, and on 11 September passed the acceptance check organized by MPT's Science & Technology Department. As one of the 10 major S&T popularization projects for MPT in the Eighth 5-Year Plan, this network will have significant demonstration value. The Hebei network incorporates the CPS-150 switching packet assembler/disassembler (SPAD) developed by the Institute of Data Research; this SPAD has an 80286 CPU and

uses the DMA [direct memory access] mode for its synchronous port. The network now links up 10 major Hebei cities, including Shijiazhuang, Qinhuangdao, Chengde, and Baoding, and is being extended out to the county level.

### Practical General-Purpose Fast Self-Optimizing Fuzzy Controller Developed

93P60047A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 3 Oct 92 p 1

[Article by Wang Yan [3769 3601]: "North China Industrial University Makes New Breakthrough in Applied Research on Fuzzy Control Theory"]

[Summary] According to expert appraisal, the general-purpose fast self-optimizing fuzzy controller practical computer developed by North China Industrial University (NCIU) via a three-dimensional correction factor algorithm and multi-use fast self-optimizing algorithm is at the international state-of-the-art for such a device. Since beginning study of fuzzy control theory in 1979, engineers in the Fuzzy Control Laboratory at NCIU's Institute of Computer Applications have developed equipment and techniques that have been incorporated into production of industrial ovens at the Benxi [Liaoning Province] Tungsten & Molybdenum Products Plant and the Beijing High-Melting Metal Materials Plant. This has resulted in annual economic benefits of 3.75 million yuan at the two plants, and yield has been raised from 65 percent to 96 percent.

### Application of Fuzzy Neural Computing in Circuit Partitioning

40100025A Beijing JISUANJI XUEBAO [CHINESE JOURNAL OF COMPUTERS] in Chinese Vol 15 No 9, Sep 92 pp 641-647

[English abstract of article by Shen Tao, Gan Junren, and Yao Linsheng, CAD Laboratory, Shanghai Institute of Metallurgy, CAS, Shanghai 200050; MS received 21 Nov 91]

[Text] Fuzzy set theory is adopted in a new neural computing algorithm fuzzy neural computing. It has been proved that the new algorithm eliminates two fatal defects facing most of the existing neural computing algorithms, i.e., the slow training speed and network parameter sensibility, and is well suited to general pattern classification tasks. Application to the partitioning of electrical circuits show that fuzzy neural computing is superior to Kohonen's self-organizing neural computing both in the sense of training speed and final results.

**Compile-Time Instruction Scheduler for RISC  
Pipeline Machine QHRC**

40100025B Beijing JISUANJI XUEBAO [CHINESE  
JOURNAL OF COMPUTERS] in Chinese Vol 15 No 9,  
Sep 92 pp 662-669

[English abstract of article by Fu Xinggang and Li Sanli,  
Department of Computer Science and Technology, Qing-  
hua University, Beijing 100084; MS received 22 Jul 91]

[Text] A parameterized instruction scheduling algorithm based on machine description table for RISC pipeline-structure machine QHRC [Qinghua RISC-based computer] is proposed. Using this instruction scheduler as a tool, the effect of several methods for solving instruction interlock problem is analyzed. Finally, a high-performance approach with both hardware feasibility and software effectiveness for solving instruction interlock problem is given. The algorithm complexity is  $O(n^2)$ .

### Atmospheric Sounding Infrared Spectroradiometer II (ASIS-2): Experimental Model

93P60042A Shanghai HONGWAI YU HAOMIBO  
XUEBAO [JOURNAL OF INFRARED AND  
MILLIMETER WAVES] in Chinese Vol 11 No 4, Aug 92  
pp 265-270

[Article by Zhang Zhaoxian [1728 5128 0341] and Wang Mochang [3769 2875 2490] of the CAS Shanghai Institute of Technical Physics (SITP), Shanghai 200083: "Atmospheric Sounding Infrared Spectroradiometer II: Experimental Model"; MS received 23 Nov 91, revised 15 Jun 92]

[Abstract] The experimental model of the Atmospheric Sounding Infrared Spectroradiometer II (ASIS-2), a 20-channel instrument for satellite-based remote sounding

of the atmospheric temperature profile and vertical distribution of water vapor, is reported. Compared with the High-Resolution Infrared Radiation Sounder (HIRS) on the U.S.-built TIROS-N/NOAA series of meteorological satellites, ASIS-2 has better optics, mechanics, and electronic circuits. The ASIS-2 sensitivity is better than that of HIRS-1 and approaches that of HIRS-2. The ASIS-2 model has the potential for incorporating two additional IR channels and numerous visible channels.

A schematic diagram of the ASIS-2 optical system is shown below in Figure 1, while main technical parameters and characteristics are given in Tables 1 and 2 below. Figures 2 and 3 (not reproduced) show a schematic diagram of the ASIS-2 electronic subsystem and a schematic of the ASIS-2 filter wheel, respectively.

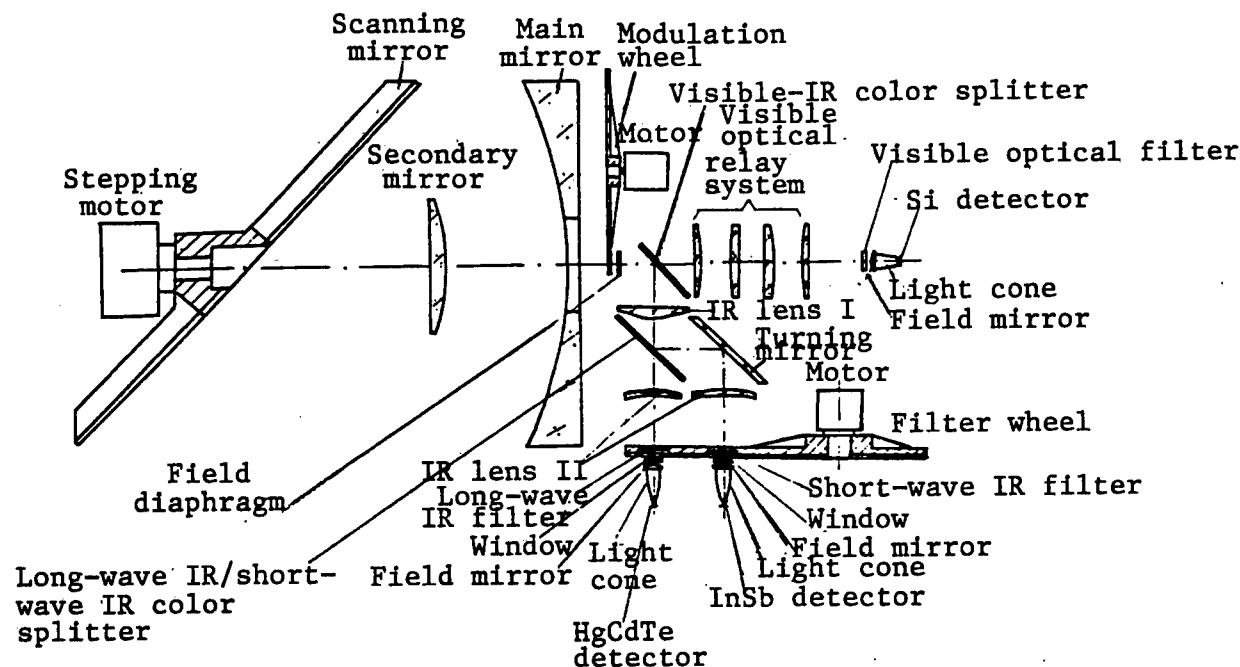


Figure 1. Optical Schematic Diagram of ASIS-2 Experimental Model



Table 1. Characteristics of ASIS-2 Experimental Model

Satellite altitude (km)	900
Satellite track angle of inclination (°)	99
Optical FOV (°)	1.225 (long-wave IR), 1.20 (short-wave IR), 1.25 (vis.)
Scanning field angle relative to ground (°)	+/- 49.5
Number of measurements per line	56
Ground swath (km)	2380
Ground instantaneous FOV (km)	19.6 (nadir, 1.25° FOV)
Stepping and staring time (ms)	100
Total scan time plus return scan time (s)	6.4
Sensitivity (NEΔN)	(See Table 2)
Radiation calibration	290K BB, 265 BB, 4K cold space
Radiation calibration period (s)	256
No. of channels	12 (long-wave IR), 7 (short-wave IR), 1 (visible) (See Table 2)
Detectors	Long-wave IR HgCdTe (6.7-15 μm), short-wave IR InSb (3.7-4.6 μm), visible Si (0.69 μm)
Telescope aperture (cm)	15
IR detector temperature	105K
Digitized bit number	13
Dimensions (optical head) (mm <sup>3</sup> )	700 x 320 x 320 (L x H x W)
Weight (optical head) (kg)	Approx. 40
Power consumption (W)	Approx. 35 (average value)

Table 2. Performances of All the Channels of ASIS-2 Experimental Model

Channel No.	Center wave number (cm <sup>-1</sup> )	Half-power bandwidth (cm <sup>-1</sup> )	Optical filter transmittance (%)	Sensitivity (NEΔN) (mW/m <sup>2</sup> -sr-cm <sup>-1</sup> )	Measurement objective
1 (2 units)	669.5	4	29	1.7	(1) Sounding of atmospheric cold-zone temperature.
2	678.0	11	70	0.48	(2) Channels 5, 6, and 7 can also be used for measuring cloud height and cloud mass within the calculated FOV.
3	690.0	11	75	0.36	
4 (2 units)	706.0	13	77	0.17	
5	715.5	15.5	68	0.25	
6	733.5	16	74	0.22	
7	750.0	16	74	0.22	Measurement of ground/cloud-top temperature, clouds.
8	893.0	36	68	0.09	
9	1026	25.5	84	0.18	Measurement of ozone content.
10	1233	55	82	0.13	(1) Detection of water vapor, providing the CO <sub>2</sub> channel and window channel with water-vapor corrections.
11	1360	39	85	0.13	(2) Channel 12 can also be used for detection of thin cirrus clouds.
12	1470	75	88	0.12	
13	2188	26.5	68	0.005	Sounding of atmospheric warm-zone temperature.
14	2206	20.5	65	0.005	
15	2240	28.5	70	0.003	
16	2263	24	72	0.0042	
17	2352	24	72	0.0026	

Table 2. Performances of All the Channels of ASIS-2 Experimental Model (Continued)

Channel No.	Center wave number (cm <sup>-1</sup> )	Half-power bandwidth (cm <sup>-1</sup> )	Optical filter transmittance (%)	Sensitivity (NEΔN) (mW/m <sup>2</sup> -sr-cm <sup>-1</sup> )	Measurement objective
18	2499	35	69	0.0026	Sounding of cloud-top temperature, or (with partial-cloud conditions) deduction of ground temperature.
19	2671	113	79	0.0007	
20	14619	971	65	<0.1%A	Measurement of clouds: daylight and 4.0 μm/11 μm jointly determined clear-sky FOV.

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## Transient Response of HgCdTe Photoconductive, SPRITE Detectors

93P60042B Shanghai HONGWAI YU HAOMIBO XUEBAO [JOURNAL OF INFRARED AND MILLIMETER WAVES] in Chinese Vol 11 No 4, Aug 92 pp 271-276

[Article by Li Yanjin [2621 6056 6210], Zhu Longyuan [2612 7893 3293], and Fang Jiaxiong [2455 1367 3574] of the CAS Shanghai Institute of Technical Physics (SITP), Shanghai 200083: "Transient Response of HgCdTe Photoconductive and Scanning Integrating Detectors"; MS received 24 Jul 91, revised 11 Oct 91]

[Abstract] The transient decay response of HgCdTe photoconductive (PC) detectors developed by SITP and HgCdTe scanning integrating (SPRITE) [signal processing right in the element] detectors developed by the Kunming Institute of Physics have been calculated and observed. The results of theory and experiment are in good agreement. At high bias fields (135 V/cm for the PC detector and 110 V/cm for the SPRITE detector), the decay processes of the PC and SPRITE detectors exhibit ramp and rectangular waveforms, respectively. According to the decay curves, the excess carrier bipolar mobility has been determined to be 245 cm<sup>2</sup>/V-s and 240 cm<sup>2</sup>/V-s, respectively.

Figures 1-6 [not reproduced] show the moving process of excess carriers, calculated results of PC decay, calculated

results of SPRITE decay, a schematic diagram of pulse biasing, experimental results of PC decay, and experimental results of SPRITE decay, respectively.

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## Fudan University Develops Porous Silicon Emitting Blue-Green Light

93P60048A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 23 Sep 92 p 2

[Article by Wu Shandi [0702 1472 1717]: "Fudan University Develops Blue-Green-Light-Emitting Porous Silicon"]

[Summary] Scientists at Fudan University's Applied Surface Physics Key State Laboratory recently announced another breakthrough for the nation's porous silicon research: they have developed a porous silicon material emitting blue-green light. Spectroscopic testing shows that this light's center wavelength is 500 nanometers, which is the shortest wavelength reported for light-emitting porous silicon to date worldwide.

## Zhejiang University Claims World's First Separation of Light-Emitting Film From Porous Silicon Wafer

93P60048B ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 25 Sep 92 p 1

[Article by Shi Yijing [0670 0001 0079] and Chen Lideng [7115 4539 4098]: "New Advance in Nation's Research on Light-Emitting Porous Silicon: Zhejiang University Separates Light-Emitting Medium From Porous Silicon"]

[Summary] Using an alkaline solution electron bombardment technique, scientists at the Zhejiang University High-Purity Silicon and Silane Key State Laboratory have achieved the world's first separation of a light-emitting thin film from a porous silicon wafer. This achievement will provide a major boost to domestic research on porous silicon light emission, and validates the not yet universally accepted theory that light emission from porous silicon is induced by a luminescent film on the surface of the silicon. After careful testing and analysis, the scientists have determined that this light-emitting film is a silicon oxide compound containing hydrogen fluoride.

### Nation's Largest Optical Fiber Faceplate Production Facility

93P60048C ZHONGGUO DIANZI BAO [CHINESE ELECTRONICS NEWS in Chinese 28 Sep 92 p 1

[Article by Gu Bingxin [7357 3521 9515]: "Foundation Laid for Nation's Largest Optical Fiber Faceplate Production Facility"]

[Summary] The foundation was recently laid for the nation's largest optical fiber faceplate production facility—the Optical Fiber Production Building at Taiyuan Radio Plant No. 4. Optical fiber faceplate is a new high-tech product consisting of millions of optical fibers bundled together to provide high-fidelity optical signal transmission in electrooptic imaging devices and displays, image intensifiers and ultra-low-light night vision equipment, etc. This material therefore has enormous military, scientific, and civilian value. The plant has contracted the complete design to the Ministry of Nuclear Industry's [CNNC's] Design Institute No. 7. Total investment is 11.17 million yuan, construction area is 4,596 square meters, and annual production capacity is 20,000 optical fiber faceplates and 5,000 microchannel plates.

### Experimental Investigation Matching Joule-Thomson Cryocooler, InSb Detector

93P60015A Hefei DIWEN YU CHAODAO [CRYOGENICS AND SUPERCONDUCTIVITY] in Chinese Vol 20 No 3, Aug 92 pp 6-9

[Article by Zhou Zanxi [0719 6363 3556] and Li Zhongmin [2621 0022 3046] of the Tianjin Jinhang Technical Physics Institute (Institute 8358) of MAS and Tu Ping [3205 1627] of Tianjin Commercial College: "Experimental Study Matching Joule-Thomson Cryocooler With Indium Antimonide Detector"; MS received 11 Feb 92, revised 19 Mar 92]

[Abstract] Open-loop Joule-Thomson (J-T) cryocoolers have been successfully used for cooling detectors in IR imaging systems (i.e., homers) on some guided missiles, such as the U.S.-made TOW and Maverick missiles. In this paper, experimental results of matching a non-self-regulating (i.e., open-loop) J-T cryocooler with an InSb detector are given, limitations of the J-T cryocooler are considered, and further development strategy is discussed.

In the first part of the experiment, with an apparatus shown below in Figure 1, the start-up time of a 7.2-mm-diameter, 40-mm-long cryocooler was measured as a function of pressure at room temperature (20°C). When gas-bottle pressure was 14 MPa, start-up time measured 16 s. Next, cooling temperature was measured as a function of pressure. When P was 9 MPa, T measured 86K, and when P was 13 MPa, T measured 92K. Then, the response and noise characteristics of the J-T cryocooler matched with the InSb detector were determined. With a 500K blackbody temperature and at a modulation frequency of 1,000 Hz, system bandwidth  $\Delta f$  measured 230 Hz. When the Dewar was immersed in liquid nitrogen, device signal voltage  $V_s$  measured 650 mV, noise voltage  $V_N$  measured 310  $\mu$ V, and detectivity  $D^*$  measured  $1.65 \times 10^{10}$  cm-Hz<sup>1/2</sup>/W. When the J-T cryocooler was used, with a nitrogen gas-bottle pressure of 15 MPa and environmental temperature of 20°C,  $V_s$  measured 390 mV,  $V_N$  was 470  $\mu$ V, and  $D^*$  measured  $0.65 \times 10^{10}$  cm-Hz<sup>1/2</sup>/W. Figures 2 and 3 [not reproduced] show curves of start-up time vs pressure and cooling temperature vs pressure, respectively.

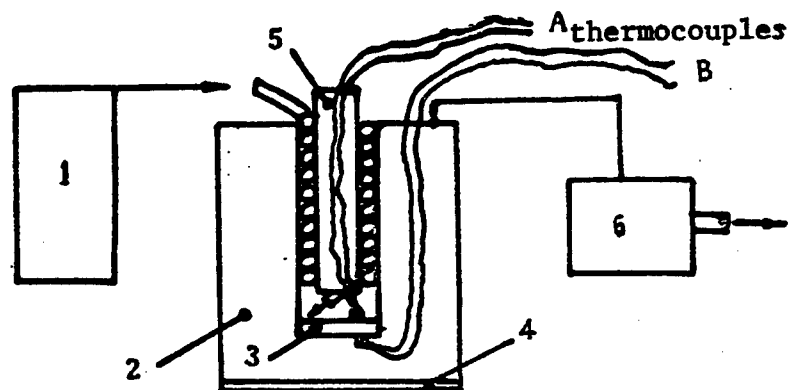


Figure 1. Schematic Diagram of Experimental Apparatus

Key: 1. High-pressure gas bottle; 2. Dewar; 3. InSb detector; 4. Gem window; 5. Cryocooler; 6. Vacuum pump

It is indicated that the J-T cryocooler has three major limitations: cooling temperature, open-loop nature, and one-time continuous operating time. For these reasons, the United States has made progress in replacing J-T cryocoolers with closed-loop (i.e., self-regulating) cryocoolers for the TOW and Maverick missiles. In China, several research institutes have developed self-regulating J-T cryocoolers and closed-loop cryocoolers with excellent performance, but more work in the area of multi-element detectors and Dewar fabrication techniques is urgently needed in order to develop a self-regulating high-power J-T cryocooler.

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#### 8 mm Pulsed IMPATT Source Designed, Developed

93P60015B Hefei DIWEN YU CHAODAO  
[CRYOGENICS AND SUPERCONDUCTIVITY]  
in Chinese Vol 20 No 3, Aug 92 pp 51-56

[Article by Li Ping [2621 5493] and Li Yong [2621 3144] of the Hefei Institute of Cryogenics and Electronics of MMEI: "Eight-Millimeter Pulsed IMPATT Oscillating Sources"; MS received 18 Dec 91]

[Abstract] High-power millimeter-wave pulsed IMPATT [impact avalanche and transit time diode] oscillators have been shown to be effective sources for solid-state millimeter-wave radar transmitters. In this paper, the design and domestic development of 8 mm pulsed IMPATT sources are introduced and the unique IMPATT properties which affect oscillator spectral purity and coherency are discussed. With this pulsed IMPATT source, a peak output power of 3.2 W with a pulse width of 0.5  $\mu$ s, pulse repetition frequency of 20 kHz, and duty cycle of 1 percent is achieved at a frequency of 30.52 GHz; frequency chirp during the bias pulse is less than 800 MHz. Nine figures show various graphs of performance and schematics of construction.

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#### 3 cm High-Frequency Radar Module Design Finalized

93P60015C Hefei DIWEN YU CHAODAO  
[CRYOGENICS AND SUPERCONDUCTIVITY]  
in Chinese Vol 20 No 3, Aug 92 p 67

[Article by Wang Huizhi [3769 1979 5347]: "3 cm High-Frequency Module Passes Design Finalization"]

[Summary] The 3-cm high-frequency module developed by MMEI's Institute 16 passed design finalization on 29 April 1992 in Hefei. This low-noise preamplifier is designed to improve high-frequency radar receiver sensitivity and range. Built to the user's requirements, this module consists of four parts: an amplitude limiter, a low-noise amp, a mirror-image suppression mixer, and an intermediate-frequency preamp. The experts at the design finalization commented that all component indicators approach or meet mid-to-late-eighties international standards. Main performance parameters are as follows: module gain  $G_p$  is 22  $\pm$  1 dB, limiting threshold level is less than or equal to 5 mW, input equivalent noise factor is less than 3 dB, output saturation level is greater than or equal to 400 mW, mirror-image suppression is greater than or equal to 18 dB, operating environment temperature range is -55°C to +85°C, external length is 132 mm, and weight is about 900 gm. Incorporation of this module into a radar receiver front end can reduce noise factor by about 4 dB, resulting in a corresponding increase of 30 percent in range.

#### Theoretical Computations of Amplified Spontaneous Emission in SG-1 FEL

40100026A Chengdu QIANG JIGUANG YU LIZI SHU  
[HIGH POWER LASER AND PARTICLE BEAMS]  
in Chinese Vol 4 No 3, Aug 92 pp 336-342

[English abstract of article by Dong Zhiwei, Tian Shihong, Yang Shenhua, and Wu Yupu, Institute of Applied Physics and Computational Mathematics, Beijing, 100080; MS received 11 Dec 91, revised 25 Mar 92]

[Text] Based on SG-1 LIA FEL amplifier parameters, the ASE output power and gain, as well as their relationship with electron beam quality (including beam energy spread, emittance, and beam intensity, etc.) are simulated and analyzed by using 3-D WAGFEL code. The related scaling law has been given. Meanwhile the influence of the wiggler magnetic field's random errors on ASE output and the experimental results are also analyzed.

Table 1. SG-1 System ASE Operating Parameters

e-beam	Microwave	Wiggler
Energy $\gamma$ : 7.85	Wavelength: 0.867 cm	Period: 11 cm
Current I: 450 A	$P_{in} = 50$ mW	Peak magnetic field: 3150 Gs
Energy spread: 3%	Noise start-up	Waveguide size: 9.8 cm x 2.9 cm
Normalized emittance: $0.47/\pi$ cm-rad		$\alpha = 2$
Initial cross section of e-beam: 1.2 cm x 0.6 cm		

Table 2. The Effect of Wiggler Field Error on ASE Output

$(\Delta B_w/B_w)_{rms}$	Different range	$P(4m)/MW$	$G/(dB\cdot m^{-1})$
$\sigma = 0.17\%$	1	0.22	18.2
	2	0.0924	17.8
	3	0.0226	14.5
$\sigma = 0.33\%$	1	0.0724	15
	2	0.0014	
	3	$10^{-5}$	
$\sigma = 0.67\%$	1	0.0015	

Table 3. The Relationship Between ASE Output and Beam Current I

$B_N$	I/A	$G/(dB\cdot m^{-1})$	P/MW
412.8	450	19.0	0.33
275.2	300	14.7	0.011
183.5	200	10.2	$0.346 \times 10^{-3}$
137.6	150	7.8	$0.28 \times 10^{-4}$

Table 4. The Influence of Beam Emittance on ASE Output Power and Gain

$B_N/A(\pi rad\cdot cm)^{-2}$	$\epsilon_x = \epsilon_y/(\pi rad\cdot cm)$	$a \times b/cm \times cm$	$G/(dB\cdot m^{-1})$	P/MW
412.8	0.06	1.2 x 0.6	19.0	0.33
308.1	0.0693	1.33x0.665	18.3	0.216
231.0	0.08	1.43x0.715	17.2	0.123
187.0	0.089	1.51x0.755	16.9	0.116
123.8	0.1095	1.67x0.836	14.7	0.018

Table 5. The Effect of Beam Energy Spread on ASE Output Power and Gain

$\Delta\gamma/\gamma\%$	$G/(dB\cdot m^{-1})$	P/MW
3	19.0	0.33
4	16.4	0.06
5	13.5	0.0046
6	9.3	$0.15 \times 10^{-3}$

Table 6. SG-1 ASE Experimental Parameters

Current I/A	50-150
Energy E/MeV	3.0
Energy spread $\delta\gamma/\gamma$	4%
Normalized emittance $e_N/(\pi\text{rad-cm})$	0.36-0.63
Peak field $B_W/\text{Gs}$	2600
Period $\lambda_W/\text{cm}$	11
Number of period $N_W$	24
Entrance of wiggler $N_W$	1.5
$(\Delta B_W/B_W)_{\text{rms}}$	0.23%

**2D-FEL Code Without Rotational Symmetry**

40100026B Chengdu QIANG JIGUANG YU LIZI SHU  
[HIGH POWER LASER AND PARTICLE BEAMS]  
in Chinese Vol 4 No 3, Aug 92 pp 349-356

[English abstract of article by Qian Sihai and Shi Yijin,  
China Institute of Atomic Energy, P.O. Box 275 (18),  
Beijing, 102413; MS received 10 Jul 91, revised 28 Dec  
91]

[Text] A 2D-FEL code with geometry infinitely extended  
in direction of electron wiggling motion is established.  
Using this code, the evolution of optical field is calcu-  
lated under the conditions of non-ideal incidence of  
e-beam, which results in exponential degradation in  
output power and the excitation of transverse higher  
modes, as well as in displacement of the centroid of  
optical beam. In this paper, it is pointed out that, besides  
the emittance of e-beam, the geometry of transverse  
phase space is also an important parameter having  
influence on FEL performance.

Table 1. Simulation Parameters

Electron beam		Undulator	
Lorentz factor	$\gamma \approx 100.32$	Length	$L_W = 500 \text{ cm}$
Energy spread	$\delta\gamma/\gamma \approx 1\%$		$\lambda_W = 8 \text{ cm}$
Emittance	$\epsilon = y\beta\gamma = 4.4 \times 10^{-3} \text{ cm-rad}$	Period	$k_W = 2\pi/\lambda_W = 0.7854 \text{ cm}^{-1}$
Beam radius (adjustable)	$R_{0e} = 0.21 \text{ cm}$		
Current	$I = 4.2 \text{ kA/cm}$	Peak magnetic field	$B_W = 2430 \text{ Gs}$
Optical field		Number of sampling electrons $N = 4096$	
Wavelength	$\lambda_s = 10.6 \mu\text{m}$	Transverse width $y_{\text{max}} = 3 \text{ cm}$	
Input power	$P_{\text{in}} = 1 \text{ MW}$		
Input waist size	$x_0 = 0.35 \text{ cm}$		

**Transport of Electron Beams in the 3.3 MeV LIA**

40100026C Chengdu QIANG JIGUANG YU LIZI SHU  
[HIGH POWER LASER AND PARTICLE BEAMS]  
in Chinese Vol 4 No 3, Aug 92 pp 373-380

[English abstract of article by Wang Guirong and Huang  
Lijin, Beijing Institute of Applied Physics and Compu-  
tational Mathematics, Beijing, 100088; MS received 14  
Mar 91, revised 21 Aug 91]

[Text] The acceleration and transport of electron beams  
in the 3.3-MeV LIA [linear induction accelerator] are  
simulated using the Electron Trajectory code SLAC-226,  
and the obtained results are compared with the solutions  
of envelope equations derived from the nonlinear theory  
of the electron beam transport. Both the code and the  
envelope equations take account of the self-  
electromagnetic field and applied electromagnetic field  
of the beam current.

**Perturbation Algorithm for Conjugate Field Construction**

40100026D Chengdu QIANG JIGUANG YU LIZI SHU  
[HIGH POWER LASER AND PARTICLE BEAMS]  
in Chinese Vol 4 No 3, Aug 92 pp 411-416

[English abstract of article by Fu Changming, Lu Lixin,  
and Sun Jingwen, Southwest Institute of Computer  
Application, P.O. Box 532, Chengdu, 610003; MS  
received 8 Oct 91, revised 28 Dec 91]

[Text] A perturbation algorithm for constructing conju-  
gate field using two deformable mirrors is presented. The  
simulations demonstrate that the diffraction intensity  
pattern with this algorithm is in good agreement with the  
wanted intensity pattern. The requirement on the  
dynamic range of deformable mirrors and the error of  
the intensity is also estimated.

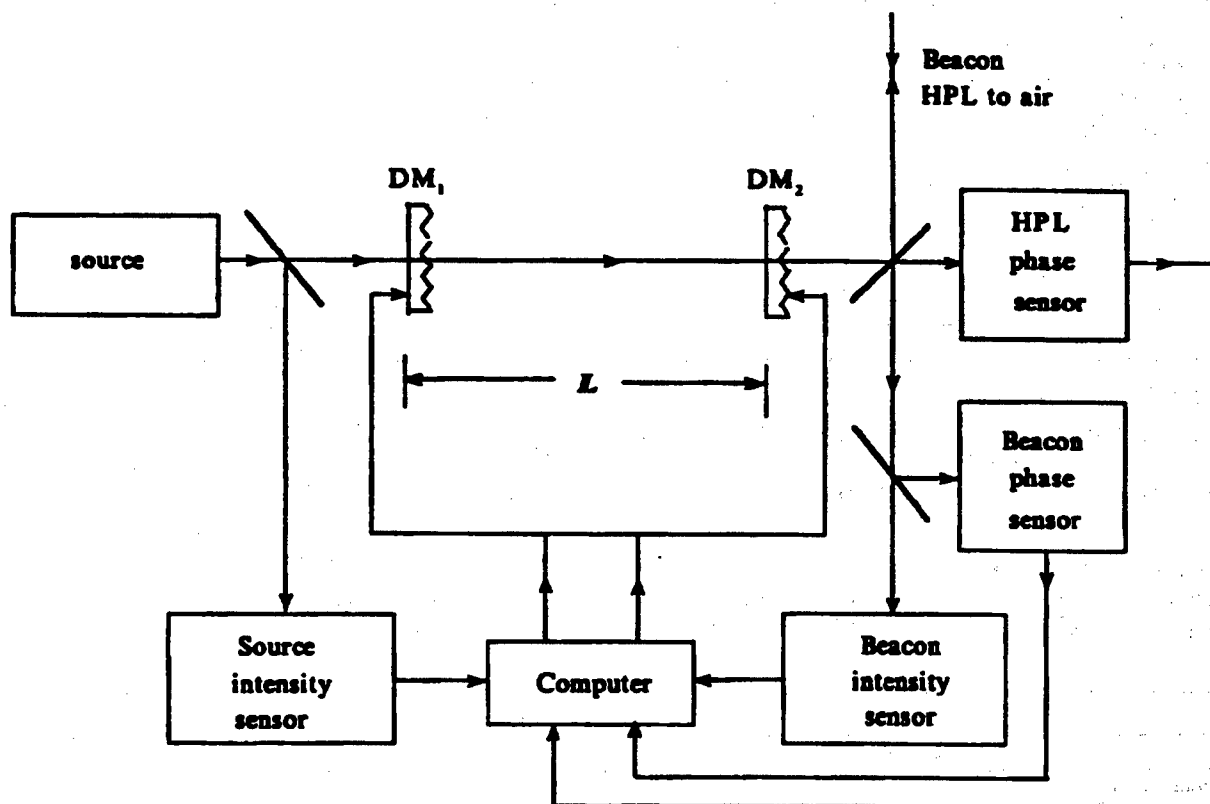


Figure 3. Scheme To Construct Conjugation Field

### Pattern Characteristics of Electromagnetic Missiles

40100024A Chengdu DIANZI KEJI DAXUE XUEBAO  
[JOURNAL OF UNIVERSITY OF ELECTRONIC  
SCIENCE AND TECHNOLOGY OF CHINA]  
in Chinese Vol 21 No 4, Aug 92 pp 358-366

[English abstract of article by Wan Changhua, Ruan Chengli, and Lin Weigan, Chengdu 610054, Microwave Testing Centre, Institute of Applied Physics, UEST of China; MS received 11 Jul 91, revised 12 Sep 91]

[Text] The interesting pattern characteristics of electromagnetic (EM) missiles in spherical coordinates are investigated for the first time. The results show that when the antenna dimension and the distance are fixed, the lobe of the EM missile becomes narrow with decrease in the waveform parameter; it also goes narrow with increase in the distance provided the other two parameters are invariant, and it will widen as the antenna dimension increases with the others fixed. Moreover, no sidelobes exist in the pattern of EM missiles and the energy of the EM missile in far-axis region drops off the same as that of the spherical wave. These conclusions are quite helpful in understanding the mechanism of EM missiles.

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**Electromagnetic Scattering, Effective Medium Parameters of Random Chiral Media**

40100024B Chengdu DIANZI KEJI DAXUE XUEBAO [JOURNAL OF UNIVERSITY OF ELECTRONIC SCIENCE AND TECHNOLOGY OF CHINA] in Chinese Vol 21 No 4, Aug 92 pp 367-374

[English abstract of article by Jia Baofu, Chengdu 610054, Institute of Applied Physics, UEST of China]

[Text] The electromagnetic scattering of random Chiral media is derived by strong fluctuation theory. The effective medium parameters of the Chiral media with strong fluctuation of the parameters are discussed.

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**Long-Wavelength HgCdTe PC Infrared Detector With Large Area**

40100017A Shanghai HONGWAI YU HAOMIBO XUEBAO [JOURNAL OF INFRARED AND MILLIMETER WAVES] in Chinese Vol 11 No 4, Aug 92 pp 277-282

[English abstract of article by Wang Zimeng, Fang Jiaxiong, Si Chengcai, Hu Yachun, and Ma Jiali of the National Laboratory of Transducer Technology,

Shanghai Institute of Technical Physics, Chinese Academy of Sciences, Shanghai 200083, China; MS received 27 May 91, revised 11 Apr 92]

[Text] A long-wavelength HgCdTe photoconductive (PC) infrared detector with large area has been developed. Simple calculations and the main points of the design are given. The detector with an area of  $2.1 \times 2.1 \text{ mm}^2$  has detectivity  $D_p^* (80\text{K}) = 1.86 \times 10^{10} \text{ cmHz}^{1/2} \text{W}^{-1}$ , and responsivity  $R_p = 386 \text{ VW}^{-1}$  with  $\lambda_{co} (50\%) > 18 \text{ }\mu\text{m}$ . An additional novel detector with a special structure of low-temperature collectors and a detectivity  $D_p^* (80\text{K}) = 7.3 \times 10^{10} \text{ cmHz}^{1/2} \text{W}^{-1}$  and  $\lambda_{co} (50\%) > 16 \text{ }\mu\text{m}$  has been developed.

**Pyroelectric Study of Molecular Organized Azobenzene Derivative Langmuir-Blodgett Films**

40100017B Shanghai HONGWAI YU HAOMIBO XUEBAO [JOURNAL OF INFRARED AND MILLIMETER WAVES] in Chinese Vol 11 No 4, Aug 92 pp 289-294

[English abstract of article by Yang Jun, Wang Rong, Tang Daxin, Dong Xijuan, and Wang Hui of the Institute of Atomic and Molecular Physics; Jiang Lei and Li Tiejun of the Department of Chemistry, Jilin University, Changchun, Jilin 130023, China; and Zhang Baowen and Cao Yi of the Institute of Photographic Chemistry, Chinese Academy of Sciences, Beijing 100012, China; MS received 30 Nov 91, revised 16 Mar 92. The project supported by the National Natural Science Foundation of China.]

[Text] Azobenzene derivative was organized as Z-type polar films at molecular level by using Langmuir-Blodgett method. The static and dynamic pyroelectric activities and frequency response were measured. The pyroelectric coefficient of 30-monolayer LB film at room temperature is about  $7 \text{ }\mu\text{Cm}^{-2}\text{K}^{-1}$ . The orientation of fatty chain and transitions moment of several main polar groups and the molecular structure were studied by using FTIR [Fourier transform infrared] linear dichroic spectra data. The effect of orientation on pyroelectric activity is discussed.

**Research on Relaxation Frequency, Modulation Properties of InGaAsP PBC Laser Diode**

40100020A Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 20 No 9, Sep 92 pp 1-5

[English abstract of article by Zhou Liya and Xu Chenghe of the Department of Radio Electronics, Beijing University, Beijing 100871; MS received Jul 91, revised Nov 91]

[Text] The relaxation frequency formula of the PBC [planar buried crescent] laser diode (LD) is theoretically derived, and confirmed experimentally. A high-speed LD module has been built with broadband modulation property up to 5.3 GHz. Using this LD module in 1 km optic fiber link, other properties are measured. It is suitable for transmitting C-band signal (3.7-4.2 GHz) from communications satellite into a subcarrier multiplexed optical fiber communication system.



**Simultaneous Ambiguity Resolution of Noisy Range, Velocity Data via CRT Algorithm**

40100020B Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 20 No 9, Sep 92 pp 27-33

[English abstract of article by Huang Zhenxing and Wan Zheng of the Department of Electronic Engineering, University of Electronic Science and Technology, Chengdu 610054; MS received 30 Aug 90, revised Feb 91]

[Text] An extended Chinese Remainder Theorem (CRT) valid for moduli non-mutually prime in integer residue sub-rings is presented. By dealing with noisy ambiguous data, an algorithm based on the CRT is developed for data ambiguity resolution, which can be used to accomplish the simultaneous ambiguity resolution of both range and velocity in medium-PRF pulse doppler radars. In addition, the conditions and probability of correct ambiguity resolution are also analyzed.

**Research on Matching Method of Stochastic Sign Change Criterion**

40100020C Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 20 No 9, Sep 92 pp 74-79

[English abstract of article by Ding Mingyue, Zhang Jianying, and Peng Jiaxiong of Huazhong University of Science and Technology, Wuhan 430074; MS received Jan 91, revised Dec 91]

[Text] A matching method of stochastic sign-change criterion is theoretically analyzed. It is proved that the sign-change number at matching point is maximum when the overlap and geometrical distortion are negligible. At the same time, the ability of anti-overlap is discussed. Finally, numerous simulation experiments are done on DPS-8/52 computer system with two machine part images. The theoretical analysis and experimental results show that the matching method of stochastic sign-change criterion not only can correctly complete image matching under the situation of  $SNR < 1$ , but also has the ability of anti-blocking.

**High-Performance Single Pulse Selector for Mode-Locked Lasers**

40100012A Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 8, Aug 92 pp 561-565

[English abstract of article by Mang Yanping, Ouyang Bin, Zhang Bingjun, Kang Yuying, and Lin Lihuang of the Shanghai Institute of Optics and Fine Mechanics, CAS, Shanghai; MS received 8 Nov 91]

[Text] The principles, design and characteristics of high-performance single pulse selectors for lasers with three kinds of avalanche transistor driver are described. They have low jitter ( $< 1$  ns), long life-time ( $> 10^7$  shots),

short delay (about 20 ns), high probability of selecting single pulse (100 percent), and high signal/noise ratio of selected single pulse ( $10^3$ ).

**Study on Induced Doping to Semiconductor by e-Beam Controlled Discharge CO<sub>2</sub> Laser**

40100012B Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 8, Aug 92 pp 606-609

[English abstract of article by Fan Anfu of the Department of Opto-Electric Science and Technology, Sichuan University, Chengdu, Zhong Tao and Lin Libin of the Physics Department, Sichuan University, Chengdu; MS received 27 Aug 90, revised 3 Oct 90]

[Text] The pulse energy of e-beam controlled discharge CO<sub>2</sub> laser is 50 J. The diameter of light spot is  $\phi 60$  mm and after being focused it becomes  $\phi 20$  mm. The induced doping of stibium (Sb) or aluminium (Al) in silicon (Si) is carried out by CO<sub>2</sub> laser. A shallower p-n junction with a diameter of 10-15 mm (max. 20 mm) and a depth of 0.2-0.7  $\mu$ m is obtained. Photo-voltage of p-n junction is about 500 mV.

**Biological Effects of Q-Switched Nd:YAG Laser Capsulotomy on Rabbit Eye**

40100012C Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 19 No 8, Aug 92 pp 637-640

[English abstract of article by Wang Kangsun, Wang Ling, Shi Haiyun, and Chen Gangqiang of the Department of Ophthalmology, Ruijin Hospital, Shanghai Second Medical University, Shanghai; MS received 30 Mar 90, revised 18 Jul 90]

[Text] Nd:YAG laser of 3 mJ, 10 ns, and 15  $\mu$ m was used to make 30 points of anterior capsulotomy arranged in a circle on the lenses of 14 chinchilla rabbits (28 eyes). Tonometries, anterior segment fluorescein angiographies, aqueous protein contents, and ERG [electroretinogram] and histological examinations were done at intervals before and after the operation. The mechanism of IOP [intraocular pressure] elevation after operation is discussed.

**Integrated Optic Mach-Zehnder Analog-to-Digital Converter**

40100022A Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 12 No 7, Jul 92 pp 652-656

[English abstract of article by Shen Ronggui, Li Baozhen, Ruan Lizhen, Zhou Yanhui, and Yin Zaisheng of the Department of Applied Physics, Shanghai Jiaotong University, Shanghai 200030; MS received 17 Jun 91, revised 13 Sep 91]

[Text] The principles of a [4-bit] analog-to-digital (A/D) converter which consists of an array of Mach-Zehnder interferometric modulators are described. The design parameters, fabrication procedure and experimental phenomena of the experimental model are reported. The measurement method and results of this model's performance are presented.

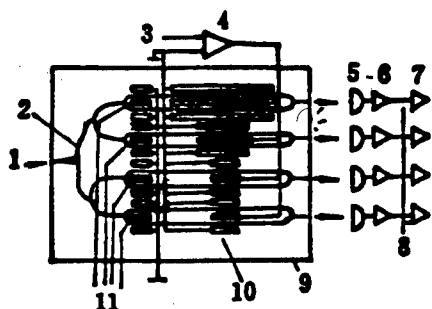


Figure 1. Schematic Diagram of a 4-Bit Electrooptic A/D Converter With Gray-Code

Key: 1. Laser; 2. Channel waveguide; 3. Analog input; 4. Amplifier; 5. APD; 6. Amplifiers; 7. Comparators; 8. Reference; 9. LiNbO<sub>3</sub>; 10. Electrodes; 11. D.C. bias

Table 1. The Parameters of the M-Z Interferometric Modulator Array

Substrate	Material	X-cut, Y-propagation LiNbO <sub>3</sub>
	Size	36 x 10 x 2 mm
Optical waveguide-Type	Channel, Ti-indiffused, Ti-500 Angstroms	6 $\mu$ m
	Width of a channel	
	Separation*	
Electrode	Type	Al
	Thickness	200 nm
	Width	50 $\mu$ m
	Space	10 $\mu$ m
	Length (mm)	L <sub>1</sub> = 16, L <sub>2</sub> = 8, L <sub>3</sub> = L <sub>4</sub> = 4, L <sub>bias</sub> = 2

\*Separation between adjacent output.

### All-Fiber Frequency Shifter Using LiNbO<sub>3</sub> SAW Device

40100022B Shanghai GUANGXUE XUEBAO  
[ACTA OPTICA SINICA] in Chinese Vol 12  
No 7, Jul 92 pp 668-670

[English abstract of article by Zhang Zhongxian, Gao Hangjun, and Long Huaisheng of the Optical Engineering Department of Zhejiang University, Hangzhou 310027, and Xie Weiye and Huang Jieping of Shanghai No. 1 Radio Factory, Shanghai 200063; MS received 2 Dec 91]

[Text] An all-fiber frequency shifter operating at 10.7 MHz is described. The device is based on a SAW [surface acoustic wave] structure using interdigital transducer on LiNbO<sub>3</sub> substrate. A frequency-shift conversion efficiency of 35 percent has been achieved with an electrical drive power of 1.5 W.

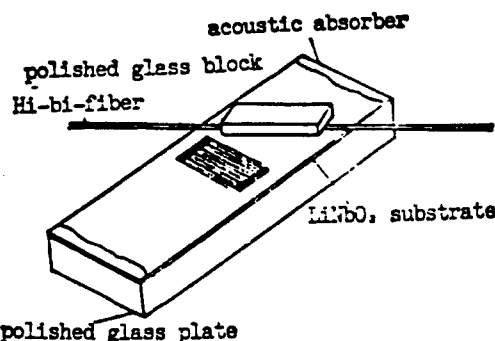


Figure 1. HiBi Fiber Pressed Onto Surface of SAW Device by Glass Pressure Plate

### Stable Output of LD-Array-Pumped CW, Quasi-CW Nd:YAG Laser

40100016A Shanghai GUANGXUE XUEBAO  
[ACTA OPTICA SINICA] in Chinese Vol 12  
No 8, Aug 92 pp 673-677

[English abstract of article by Zhou Fuzheng, Shen Liqing, Zheng Guizhen, and Fan Dianyan of Shanghai Institute of Optics and Fine Mechanics, Shanghai 201800; MS received 13 Sep 91, revised 25 Nov 91]

[Text] A stable CW and quasi-CW Nd:YAG laser was pumped by a domestically made DH [double heterojunction] laser diode (DH-LD) array with CW power of 100 mW and pulse power of 200 mW. Continuous output power of 12 mW and pulse power of 20 mW at repetition rates of 10-50 kHz were obtained, respectively. The power fluctuation is less than 0.5 percent. The calculated values are in agreement with the experimental results.

### Investigation on Thermal Stability of Solid-State Slab Laser

40100016B Shanghai GUANGXUE XUEBAO  
[ACTA OPTICA SINICA] in Chinese Vol 12  
No 8, Aug 92 pp 693-696

[English abstract of article by Liao Yan, He Huijuan, et al. of Shanghai Institute of Optics and Fine Mechanics, Shanghai 201800; MS received 2 Jul 91, revised 5 Dec 91]

[Text] A slab laser is operated thermal-stably with almost invariant divergence angle within a pump power ranging from 150 W to 10,000 W. The maximum laser output power is over 150 W. Compression of output divergence angle by placing suitable cylindrical lens into the resonator is also reported.

**Temperature Dependence of Absorption Spectra of Aggregates in the LB Films of Tetra-Neopentoxo Phthalocyanine Zinc and Tetra-Nonyl Phthalocyanine Copper**

40100016C Shanghai GUANGXUE XUEBAO  
[ACTA OPTICA SINICA] in Chinese Vol 12 No 8,  
Aug 92 pp 723-728

[English abstract of article by Luo Tao, Zhang Weiqing, Qi Changhong, and Gan Fuxi of Shanghai Institute of Optics and Fine Mechanics, CAS, P.O. Box 800216 Shanghai 201800, China; MS received 15 Aug 91, revised 18 Oct 91]

[Text] Langmuir-Blodgett (LB) films of tetra-neopentoxo phthalocyanine zinc (TNPPcZn) and tetra-nonyl phthalocyanine copper (TNPCu) are prepared. Absorption spectra at different temperatures are measured and aggregates of the films are studied. There are a strong peak at 680 nm and a sideband at 620 nm, which correspond to monomer and dimer, respectively, in absorption spectra of TNPPcZn films at room temperature. The monomer is transformed irreversibly into the dimer gradually with temperature increasing. The

absorption spectra of TNPCu LB films at room temperature show that there are monomer, dimer and J-aggregates, which cause a strong peak at 740 nm, in the LB films. The J-aggregates are destroyed at high temperature and restored again when the temperature is decreased.

**Three-Axis Image-Stabilizing Reflecting Prism Assembly in Convergent Light**

40100016D Shanghai GUANGXUE XUEBAO  
[ACTA OPTICA SINICA] in Chinese Vol 12 No 8,  
Aug 92 pp 749-754

[English abstract of article by Zhao Yuejin and Lian Tongshu of the Department of Optical Engineering, Beijing Institute of Technology, Beijing 100081; MS received 29 Jul 91, revised 25 Oct 91]

[Text] On the basis of conjugation theory for reflecting prisms, a method for image stabilization involving three degrees of freedom with only two prisms is proposed in convergent light, and its respective formula is deduced. With the help of optimization and computer, the formula is optimized. A new way is offered for image-stabilizing involving more degrees of freedom.

### Time-Resolved Photoluminescence Study of 1.48 eV Emission Band in Epitaxial n-Type GaAs

40100023A Beijing BANDAOTI XUEBAO  
[CHINESE JOURNAL OF SEMICONDUCTORS]  
in Chinese Vol 13 No 9, Sep 92 pp 523-527

[English abstract of article by Duan Jiaqi, Department of Physics, Beijing University, Beijing, 100871; MS received 28 Jun 91, revised 29 Oct 91]

[Text] An emission band in the energy position of 1.48 eV has been observed in epitaxial n-type GaAs grown by VPE. The optical properties of the 1.48 eV band are similar to those of the well-known 1.49 eV band. The radiative life-time and time-resolved spectrum measurements at low temperature have confirmed that the 1.48 eV band is attributed to the recombination emission of the neutral donor-neutral acceptor pairs originated from silicon acceptors.

### Study of Infrared Transmission Spectra for Measuring Carrier Concentration of Heavily Doped Compound Semiconductors

40100023B Beijing BANDAOTI XUEBAO  
[CHINESE JOURNAL OF SEMICONDUCTORS]  
in Chinese Vol 13 No 9, Sep 92 pp 573-578

[English abstract of article by He Xiukun, Wang Qin, et al., Tianjin Electronic Materials Research Institute, Tianjin, 300192; MS received 9 Apr 91, revised 14 Aug 91]

[Text] The carrier concentrations in heavily doped compound semiconductors (n-GaAs and n-InP) are measured using infrared transmission method. The relation

between carrier concentration (N) and threshold-wavelength ( $\lambda_c$ ) is given; the empirical formulas follow  $N = 1.09 \times 10^{21} \lambda_c^{-3.0623}$  and  $N = 3.58 \times 10^{20} \lambda_c^{-2.6689}$  for n-GaAs and n-InP, respectively. The measurement range and precision of carrier concentration are  $1.0 \times 10^{17} \leq N \leq 2.0 \times 10^{19} \text{ cm}^{-3}$  and plus or minus 10-15% with above method. The measurement conditions are discussed in detail. The radial distribution of carrier concentration for GaAs:Si samples are also shown.

### Ga<sub>1-x</sub>In<sub>x</sub>Sb/GaSb Strained Layer Superlattice Grown by MOVPE

40100023C Beijing BANDAOTI XUEBAO  
[CHINESE JOURNAL OF SEMICONDUCTORS]  
in Chinese Vol 13 No 9, Sep 92 pp 584-587

[English abstract of article by Lu Dacheng, Wang Du, Liu Xianglin, and Wan Shouke, Laboratory of Semiconductor Materials Science, Institute of Semiconductors, CAS, Beijing, 100083; and Wang Yutian, Institute of Semiconductors, CAS, Beijing, 100083; MS received 9 Mar 91, revised 27 Apr 91]

[Text] Ga<sub>1-x</sub>In<sub>x</sub>Sb/GaSb strained layer superlattice (SLS) were grown by metal-organic vapor phase epitaxy on GaSb buffer layer in a horizontal reactor at atmospheric pressure by SM35A MOVPE system made by ourselves. The samples were examined by double-crystal X-ray diffraction, reflection electron microscopy (REM), and low-temperature photoluminescence spectra (PL). The double-crystal X-ray diffraction and REM show that the SLSs have good period, uniform fraction of Ga or In in GaInSb and abrupt interface. The misfit dislocations appear at the interface of SLS and substrate when In fraction in GaInSb increases. Low-temperature PL show that the interband transition shifts toward high energy owing to the quantum size effect.

# Advances in Superconducting Electronics Highlighted

93P60049A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 2 Oct 92 p 1

[Article by Gao Zhu [7559 2691]: "Gratifying Advances in Superconducting Electronics Research"]

[Summary] In recent years, the nation's scientists have realized gratifying advances in superconducting electronics research—with some applied results meeting internationally advanced standards. China's high-critical-temperature superconducting (HTS) materials and theoretical research are in the world's front ranks; domestically developed HTS thin films, for example, are at the international state-of-the-art in terms of main performance indicators such as critical temperature, critical current density, and surface resistance. In the area of superconducting electronic devices, relatively high technical performance has been demonstrated by superconducting microwave resonators, superconducting microwave filters, superconducting microwave antennas, superconducting microwave delay lines, and superconducting microwave microwave signal detectors.

## Superconducting Multiturn Coils of YBCO-SrTiO<sub>3</sub>-YBCO Films

40100018A Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 14 No 5, Sep 92 pp 326-330

[English abstract of article by Liu Rangjiao, Zeng Xianghui, Wang Shiguang, and Dai Yuandong of the Department of Physics, Beijing University, Beijing 100871; MS received 13 Dec 91]

[Text] The procedure for fabricating superconducting multiturn coils of YBCO-SrTiO<sub>3</sub>-YBCO films is described. Each film is grown in situ by RF magnetron sputtering onto a heated (100) SrTiO<sub>3</sub> substrate. The geometrical configuration of each layer is patterned by ion mill and only photolithographic masking. The 9-turn coils of 10  $\mu$ m linewidth have a transition temperature of 82K and a critical current at 77K of 0.8 mA, corresponding to a critical current density of  $5.4 \times 10^4$  Acm<sup>-2</sup>. The resistivity of SrTiO<sub>3</sub> between the YBCO films at 77K was about  $3.9 \times 10^3$   $\Omega$ cm.

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## Harmonic Mixer in 3mm-Band at Liquid-Nitrogen Temperature

40100018B Beijing DIWEN WULI XUEBAO [CHINESE JOURNAL OF LOW TEMPERATURE PHYSICS] in Chinese Vol 14 No 5, Sep 92 pp 346-350

[English abstract of article by Jin Biaobin, Cheng Qiheng, Xu Weiwei, and Wu Peiheng of the Department of Information Physics, Nanjing University, Nanjing 210008; Yan Shaolin of the Department of Electronics, Nankai University, Tianjin 100071; and Shao Kai of Nanjing Electronic Devices Institute, Nanjing 210016; MS received 7 Dec 91]

[Text] Two kinds of TiCaBaCuO films, which have island-shaped and bar-shaped structures, were used to fabricate grain-boundary Josephson junctions with conventional chemical etching. The sizes of them are 10 $\mu$ m long and 5 $\mu$ m wide. When radiation at a frequency of 36.5 GHz was applied to them, it was found that Shapiro steps were easily observed for the junctions with the bar-structure. This shows that these junctions are suitable for harmonic mixing, which has been carried out between 90.8 GHz and 1.08 GHz in liquid nitrogen. The highest harmonic number is 84.

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**MMEI Vice Minister Points Out 10 Major International Cooperation Areas for Nation's Telecommunications Industry**

93P60050A Beijing ZHONGGUO DIANZI BAO  
[CHINA ELECTRONICS NEWS] in Chinese  
23 Sep 92 p 1

[Article by Jin Jianguo [6855 1696 0948]: "Nation Sets Eighth 5-Year Plan Sino-Foreign Cooperative Projects in Communications Industry: Third China International Communications Conference Convened in Beijing"]

[Summary] At the Third China International Communications Conference convened in Beijing on 16 September, MMEI Vice Minister Zeng Peiyan specified the 10 major Sino-foreign cooperative projects for the nation's telecommunications industry in the Eighth 5-Year Plan. These projects are: 1) Establishment of an R&D center for communications system software and communications ASICs; 2) development of stored-program-controlled (SPC) telephone switches, including end-office digital switches, rural switches, and a system for manufacturing digital PABX parts and complete units, as well as construction of end-office switch production bases in Beijing, Tianjin, and Shanghai and of an R&D center for developing a new generation of end-office digital switches; 3) development of mobile communications, including a cellular system, pagers, police/emergency mobile phones, industrial (railroad and mining) mobile phones, adaptive single-sideband communications equipment and other special-purpose mobile communications equipment; 4) importation of production lines and design technology for DS4-and-higher [i.e., 140 Mbps-and-higher] fiber-optic communications systems, and establishment of an organization for developing DS5 (662 Mbps in the SDH [synchronous digital hierarchy]) fiber-optic communications systems; 5) development of satellite communications (SATCOM), including importation of digital-telephone-compatible VSATs [very small aperture terminals], low-bit-rate VSATs, and medium-capacity trunkline SATCOM systems; 6) development of digital microwave (DMW) communications, including 480-circuit-and-higher mid-to-high-capacity DMW communications equipment, point-to-multipoint DMW communications equipment, and TV microwave transmission equipment; 7) development of communications terminal equipment, including G3 FAX machines, multifunctional telephones, videophones, data terminals, and secure transmission devices, and construction of facilities for manufacturing G3 FAX machine parts and entire units; 8) development of navigational communications equipment, including air and harbor traffic control systems, global marine search-and-rescue systems, and GPS [global positioning systems] receivers; 9) resolution of the narrow-band integrated services digital network [ISDN] application problem, and active promotion of research on broadband ISDN systems; and 10) joint construction by MMEI and the Weihai Municipal Government of the Weihai Electronics Industrial Park's Communications Mini-Zone, oriented toward development of high-speed FAX machine key components and cellular mobile communications systems, as well as

other economic equipment in the future, with the eventual goal of establishing an economics development/export base.

It is understood that the nation's Eighth 5-Year Plan telecommunications market demand is quite high: telephone switches for 35 million lines, 900,000 units of wireless mobile communications equipment of various types, 3 million wireless pagers, 1 million kilometers of optical fiber, 100,000 kilometers of fiber-optic cable, 100,000 optoelectronic terminals, 130,000 kilometers of DMW circuits, 2,000 SATCOM earth stations, 10,000 satellite VSATs, and 30 million telephone sets.

**Nation's First Fiber-Optic Cable TV Network Operational**

93P60050B Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 29 Sep 92 p 1

[Article by Ye Rong [0673 5554]: "First High-Tech Fiber-Optic Cable TV Network Operational in Jiading County"; cf. early report in JPRS-CST- 91-024, 23 Dec 91 p 27]

[Summary] The nation's first high-tech fiber-optic cable TV network, in Shanghai Municipality's Jiading County, was recently completed and is now operational. Designed by Shanghai University of Science & Technology and included by the State in its list of 1992 Key Research Projects, this new cable TV network now provides high-quality TV program reception to over 3,000 residential families in two small districts; each evening residents can choose from among eight TV programs. It is understood that this network can simultaneously transmit up to 46 programs, and that the new network has operated well in trials beginning on 1 May of this year.

**Formatted-Network CDMA SATCOM Earth Station Operational**

93P60050C Beijing ZHONGGUO DIANZI BAO  
[CHINA ELECTRONICS NEWS] in Chinese  
5 Oct 92 p 3

[Article by Liu Zhiwen [0491 5347 2429]: "Formatted-Network Code-Division Satellite Communications Earth Station Enters Functional Stage in China"; cf. early report in JPRS-CST-92-004, 20 Feb 92 p 38]

[Summary] A formatted-network CDMA [code-division multiple access] SATCOM earth station of the type jointly developed and manufactured by Beijing University and the Shanxi Galaxy Electronic Equipment Plant has been installed in one of China's frontier regions and is now operational, indicating that this type of SATCOM earth station has entered a functional stage. This point-to-point dedicated SATCOM network incorporates microcomputer control, permitting any station to freely enter the network for simplex computer data and simplex vocoded telephone communications. This equipment can also be used for electronic mail, data searches, intelligence and information transmission, and other types of low-bit-rate data communications.